# Supply and Demand Shocks in the CIS Countries

By

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# Abstract

I assess the correlation of supply and demand shocks between the CIS countries and three large Western European countries between 2000-2010 using the structural vector autoregressive model. I find that Russia has a high correlation of supply shocks with Kazakhstan, Belarus and the European countries. I foresee that further integration within the Customs Union (Russia, Belarus, and Kazakhstan) is likely to synchronize the business cycles and create conditions for formation of the currency union.

# Acknowledgements

I am heartily thankful to my supervisor, Julius Horváth, whose guidance enabled me to write this thesis. I also offer my regards and blessings to all of those who supported me in any respect during the completion of my degree.

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# Introduction

In 1991 the Soviet Union collapsed.  Shorty after that all post-Soviet countries introduced their own currencies. These currencies later – in most cases - were pegged to the U.S. dollar or the German mark. Different supranational organizations were formed, for example the Commonwealth of Independent States (CIS), the Customs Union, and others. However the national economies have since been diverging from each other. One can raise a question in this respect: how much are these countries different, and to what extent do their business cycles coincide.

In my thesis I examine the correlation of supply and demand shocks between the CIS countries. The results might help to answer another question whether the CIS countries form an optimal currency area (OCA) and whether there is some potential for forming a currency union.

Currency unions can mainly be divided into two types of formations. The first case is when a group of countries issue a new currency and found a new joint central bank. The second case is when small countries adopt the currency of a large anchor country (Alesina, Barro, Tenreyro, 2003). Both options theoretically can be employed to form a currency union in case of CIS countries.

Literature of OCA describes many potential benefits of having a currency union.  By forming a currency union its members can reduce the transaction costs of trading. They benefit from the stability of exchange rate regime. The monetary policy might be more successful due to the more efficient monetary control (Horvath, Ratfai 2004). For small non-stable economies it might be good to join a currency union to reach stability in the economy, especially to limit inflation.

Entering the currency union bears some costs as well. When business cycles in countries do not coincide, the members of currency union cannot use potential stabilizing instruments to

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smooth the effect of negative shocks (Frankel, Rose 1996). There is a risk that a higher degree of co-integration within a currency union might make a country more sensitive to shocks. It can happen when the degree of specialization increases. The decision to form a currency union is a trade-off between the costs and benefits. In my thesis I do not consider political reasons to form a currency union. Different tolerance to inflation and budget deficit also are not taken into account, I focus my research mainly on the symmetry of shocks.

The theory of OCA started from the discussion of the choice between the fixed and flexible exchange rate regimes. Robert A. Mundell (1961) and subsequent authors identify the criteria that countries should satisfy to form a currency union. Symmetry of shocks is one of the criteria. In my thesis I am going to use the approach of Tamim Bayoumi and Barry Eichengreen (1993) to identify structural shocks in the CIS countries. In their work Bayoumi and Eichengreen employed the vector autoregression method suggested by Oliveir J. Blanchard and Danny Quah (1989).

I am going to carry out the analysis for seven CIS countries and Georgia, and three countries from the European Union, France, Germany and Italy. The last four and Russia are the anchor countries in this analysis. The quarterly seasonal unadjusted data for real and nominal GDP from 2000 to 2010 are collected from the UNECE Statistical Database. The analysis shows that countries that are member of the Customs Union (Russia, Kazakhstan and Belarus) correspond to the criteria of symmetric supply shocks. Meanwhile other CIS members don't have symmetry in shocks and the membership in a monetary union can be problematic.

This paper is organized as follows. The next section reviews the literature on an optimal currency area theory. The third section describes the methodology that is implemented to identify supply and demand shocks. The fourth section describes the data and provides the results of the analysis. The last section concludes.

# Background

An international currency union is based on the cooperation in monetary and currency policies among several independent countries by fixing their exchange rates. In the end their currencies might be replaced by a single currency. Having a common currency does not always assume having a single central bank or other authorities. For example, there was no united central bank in the Scandinavian Monetary Union (1873-1914). A large amount of currency unions appeared in the 19-th and in the beginning of the 20-th century. In the modern history the most important one is the Economic and Monetary Union in Europe (Kærgård, Henriksen 2003).

The theory of currency unions started from the discussion of choice between the fixed and the flexible exchange rate regimes. The three most influential papers are by Mundell (1961), Ronald I. McKinnon (1963), and Peter B. Kenen (1969), who sought to show that an economy's characteristics should be a determinant of its exchange-rate regime. They defined country characteristics that are important for choosing an exchange-rate regime. Indeed Mundell's theory tries to refute the case suggested by Milton Friedman (1953) in favor of the flexible exchange rate regime (Dellas, Tavlas 2009).

In his work Friedman suggests three arguments in favor of the floating exchange rates regime. The first is that the system of floating exchange rates would equilibrate the economy with the sticky prices and wages, which are typical in the real world. The second one is that floating exchange rates would provide an opportunity to conduct independent monetary policy. The third argument is that flexible exchange rates would promote multilateral trade by decreasing the control of the movements of goods and capital among countries.

In turn Mundell argues that economic conditions should define the exchange rate regime. He attempts to identify the conditions under which the flexible exchange rates will be ineffective. In his opinion, an optimal currency area (OCA) should be restricted in such way

that it allows internal and external balance to be achieved. The labour mobility and wage-price stickiness are the key elements of an optimum-currency-area since it reduces the need of nominal exchange rate adjustment. Mundell names several factors that are in favour of a relatively-large currency area. Firstly, the efficiency of money as a medium of exchange and a unit of account decreases if the number of currencies increases. Secondly, the speculation risk is higher for smaller currency areas; as a result it is more difficult to adopt a unified monetary policy. The factors mentioned before characterize the openness of economies (Dellas, Tavlas 2009).

In his paper, McKinnon shares this opinion that the openness should be a criterion for optimality of an exchange rate regime. He identifies an open economy as one with sufficient amount of tradable goods. The relatively open economies should peg their currencies to protect themselves against the exchange rate changes. The closed economies will profit from the flexible exchange rates regime. McKinnon also raises the question of the size of an economy. Money should have the liquidity value for inhabitants of considered area, to ensure the liquidity value the country should have the sufficiently large amount of non-tradable goods. The presence of a stable large economy is necessary for small countries for an efficient pegging their currencies (Horvath 2003).

Kenen's contribution to the theory of optimal currency area develops the idea that the ability to smooth the effects of asymmetric shocks is the criterion for optimal currency area. One of the factors that helps to smooth asymmetric shocks is the higher level of fiscal integration. The second is the degree of diversification in the economy; the idea is that positive changes in demand for one product are compensated by negative changes in the demand for another one. The higher degree of diversification the better offsetting mechanism works (Dellas, Tavlas 2009).

The authors mentioned above consider the criteria that are connected with the state of an economy. Subsequent literature moves toward the criteria depended on the policy trade-offs. These criteria are degree of policy integration, similarity of rates of inflation, degree of price and wage flexibility, and real exchange rate variability. Marcus J. Fleming (1971) claims that if there is need for a real exchange rate adjustment due to shocks there is no difference if it happens through prices, wages, or exchange rates. In reality not all mechanism might work (Horvath 2003).

Recent discussion turned to expectation formation, credibility, and time consistency. For example, a high inflation country can gain credibility pegging its exchange rate to a low inflation country. There are tree approaches in literature in this area. The first one considers which exchange rate regime will ease the response of the economy to different disturbances. The second one treats the choice of exchange rate regime as the stabilization instrument. The third approach is based on microeconomic foundation. For example, Bayoumi (1994) considers changes in welfare of members and the potential entrant of a currency union. One of conclusion Bayoumi makes is that "a small region has greater incentive to join a union than the union will have an incentive to admit the new member" (Horvath 2003, p. 21).

Based on the theoretical papers examined, it can be concluded that the optimality of currency union is based on an ability to sustain the internal and external equilibria. The internal equilibrium includes full employment and low inflation. The external equilibrium is the one in which there is no risk of a country or counterparty's defaults. The ability to maintain equilibrium depends on a country's characteristics. The OCA theory provides the following criteria of optimality:

- The size of an economy and the degree of openness and/or trade integration

For a small open economy it is easy to peg its currency to the one of its trade partner with a big and stable economy

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- The flexibility of economic structure and factor mobility

The flexible exchange-rate regime allows regulating relative prices, while in the case of a pegged currency the authorities cannot use this instrument anymore, therefore they should resort to another instrument. The higher is the mobility of production factors, prices and costs, the more competitive and efficient country is.

- The incidence of asymmetric shocks and the degree of product diversification, the similarity of economic structures between two economies

The more diversified production in an economy, the less sensitive it is to shocks. However, the group of countries that form the union should be more homogeneous in order to avoid transferring shocks from one to another.

- The access to support and the level of fiscal integration

If one of the countries is not able to sustain the exchange rate because of some reasons, other countries in the union should support it, for example, with financial help. Countries in a currency union should ideally have common fiscal and monetary policies. If there is no coordination among countries they should give up the currency union.

The main reason to form a currency union is to increase the utility from using money. Currency integration might decrease transaction costs and by reducing the currency risks lower the hedging costs. The wider the area of common currency, the higher the utility coming from it.

The integration of financial markets might increase the efficiency of financial interactions. Political integration might raise the efficiency of monetary policy and there is also the potential for economizing currency reserves. Furthermore, a lower amount of reserves is needed.

The main disadvantage of a currency union, as seen from the criteria of optimality, is the loss of independency in monetary policy that decreases possibility to achieve the internal

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equilibrium. The costs of a currency union are high if the economy has a high unemployment rate or if there is big pressure from internal prices and wages because of the presence of monopolies, labour unions and long contracts.

In the following paragraph some examples of pegging currencies are discussed. For the last 60 years virtually all countries that pegged their currencies chose to peg them either to the U.S. dollar or to the German mark (Meissner, Oomes, 2009), later to a basket of currencies. Between 1950 and 1972 the most popular anchors among developing countries were the U.S. dollar, the British pound and the German mark. After the collapse of Bretton Woods the U.S. dollar declined significantly in popularity, and the British pound almost stopped being used. The amount of free and managed floating currencies and those that pegged to the German mark increased significantly.

After the Soviet Union collapsed a large number of "freely falling" currencies appeared. Countries that were in the Soviet Union or under its influence chose to peg their currencies to the U.S. dollar or the German mark.

The choice of the German mark and later the Euro was determined mainly by the close interrelations between the countries and the EU. For example, by far the larger part of Estonian foreign trade was with the EU, so there is no big chance of a fundamentally different phase of the economic cycle in Estonia and in other countries in the European Union (Meisner, Oomes 2009, p. 527).

The problem with other post-Soviet countries is that they mainly chose the U.S. dollar although they had higher volume of trade with Europe. This is an example of bad coordination among countries. For all these countries it is good to have the same anchor. It would be more reasonable to have the Euro as an anchor. Another option would be a local monetary agreement (Meisner, Oomes 2009, p. 529).

The question of the possibility of a local monetary agreement between CIS countries has been raised because these countries are still significantly interconnected and experience similar phases of economic cycles. This fact is the result of joint development during the Soviet time. But there is an open question why the monetary union was not formed after the Soviet Union collapsed.

Disintegration of the Soviet Union led to the existence of several independent central banks that could issue ruble credits at the expense of the rest of the system; especially Ukraine and Russia were active in this area. It was the reason for others to separate their currencies. To avoid an increase in inflation induced by reflow of rubles into Russia rubles issued before 1993 were demonetized.

Individual countries had different inflation tolerance and different financing requirements (Cheikbossian, G. 2001). Estonia and Lithuania had budget surpluses; meanwhile Russia had a government deficit of around 20% of GDP. Also the Baltic countries had less tolerance to inflation and wanted to stabilize their currencies faster. Estonia pegged its currency to the German mark, Lithuania and Latvia chose the floating exchange-rate regime backed by gold reserves.

What would facilitate completing a local monetary agreement? First of all is close coordination in fiscal issues because of trade and policy interactions, free-riding behavior and external effect. Second is the definition of roles of small and big countries in monetary agreement. If neither switching to the Euro nor the local monetary agreement worked it might be better to stick with the U.S dollar.

In the next section I will describe the method I am going to use to analyze whether the CIS countries are exposed to symmetric supply and demand shocks. It will help me to answer the question which CIS countries can benefit from higher degree of integration or a potential currency union. Similar methodology was applied in many research papers. For example,

Zhaoyong Zhang, Kiyotake Sato and Michael McAleer showed that before financial crisis (1997), supply shocks were correlated significantly among Singapore, Malaysia, Indonesia, and Thailand, and among Hong Kong, Japan, Korea and Taiwan (Zhang, Sato and McAleer 2004). Licandro Ferrando estimated shock correlation of real GDP over the period 1975-1996 for MERCOSUR. He found that the shock correlation between Argentina and Brazil, Argentina and Uruguay, and Brazil and Uruguay were statistically not significant from zero. However the supply shock correlations became positive and statistically significant when the estimates were conditioned on countries' exchange rates stabilization programs (Fratianni 2004, p. 85). Stefan Eichler and Alexander Karmann in their research found that Latin American, Middle Eastern countries do not yet form optimal currency areas, however the bilateral currency unions among some countries could be desirable (Eichler, Karmann 2010).

# Analytical framework

Studies on an optimal currency area often focus on co-movements of macro variables across countries. Such studies when using time series data are based on the vector autoregressive (VAR) model which can be used to analyze the relationship between different factors and help to specify the line of causality in the context as developed by Granger. The drawback of this concept is that it may not reveal true and complete information about the interactions between the variables of a system. The response of one variable to an impulse of another variable is more often of interest to a researcher. The later variable can be called a causal one, for example, the effect of an exogenous shock in one variable can be the cause of changes in others (Lütkepohl 2005).

In my thesis, Bayoumi and Eichengreen's approach was followed (Bayoumi and Eichengreen 1993). In their paper the authors identified the structural shocks by using the structural vector autoregression (SVAR) method as suggested by Blanchard and Quah (Blanchard and Quah 1989).

A SVAR model demands economics background. Bayoumi and Eichengreen assume the downward sloping demand curve, the upward sloping short-run supply curve and the vertical long run supply curve in the price-output plane. This model implies that a demand shock leads to a short term rise in output and then gradual return to initial level with permanent increase in prices. Supply shocks are assumed to be permanent, for example, a technology shock. The supply shocks have the following effects on the economy: the price level decreases, and the output level increases. The raise of output level is permanent, as opposed to demand shocks.

The Bayoumi and Eichengreen's model is described by an infinite moving average representation of a vector $(\Delta y_t, \Delta p_t)'$ denoted as $X_t$ and an equal number of shocks $e_t$ $(e_s, e_d)'$.

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The variable $y$ stands for the logarithm of real GDP, and $p$ stands for the logarithm of prices. The process can be written as the following if the lag operator L is used:

$$X_t = A_0 e_t + A_1 e_{t-1} + A_2 e_{t-2} + A_3 e_{t-3} + \ldots = \sum_{j=0}^{\infty} L^j A_j e_{t-j}$$

where the matrices $A_j$ are the impulse response functions of the shocks to the elements of $X_t$, or using other notation:

$$\begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = \sum_{j=0}^{\infty} L^j \begin{bmatrix} a_{11j} \ a_{12j} \\ a_{21j} \ a_{22j} \end{bmatrix} \begin{bmatrix} e_{dt} \\ e_{st} \end{bmatrix}$$

As mentioned before demand shocks have temporary effect on the level of output. It means that the cumulative effect of demand shocks on the output written in the first difference form should be zero. In other words the following restriction should hold:

$$\sum_{j=0}^{\infty} a_{11j} = 0$$

To estimate the model described above by using VAR each element of vector $X_t$ needs to be regressed on lagged value of all the elements of $X$. The result can be presented in the following form:

$$\begin{aligned} X_t &= B_1 X_{t-1} + B_2 X_{t-2} + \ldots + B_n X_{t-n} + \varepsilon_t \\ &= (I - B(L))^{-1} \varepsilon_t \\ &= (I + B(L) + B(L)^2 + \ldots) \varepsilon_t \\ &= \varepsilon_t + D_1 \varepsilon_{t-1} + D_2 \varepsilon_{t-2} + D_3 \varepsilon_{t-3} + \ldots \end{aligned}$$

where $\varepsilon_t$ are residuals from the equation in the vector autoregression.

The relation between residuals $\varepsilon_t$ and the supply and demand shocks can be written as the equality $\varepsilon_t = C e_t$. To define the matrix $C$ four restrictions are needed. Two of them are the normalization defining the variance of the supply ($e_{st}$) and demand ($e_{dt}$) shocks. The third one is derived by assuming that demand and supply shocks are orthogonal. The forth restriction

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comes from the fact that demand shocks have only temporary effects on output, or in matrix form:

$$\sum_{j=0}^{\infty} \begin{bmatrix} d_{11j} \ d_{12j} \\ d_{21j} \ d_{22j} \end{bmatrix} \begin{bmatrix} c_{11} \ c_{12} \\ c_{21} \ c_{22} \end{bmatrix} = \begin{bmatrix} 0 \ . \\ . \ . \end{bmatrix}$$

There exists criticism of this methodology. Minford (1993) criticizes Bayoumi and Eichengreen by arguing that their decomposition into the "demand" and "supply" shocks is only the decomposition of temporary and permanents shocks, not structural ones. The "demand" shocks here are nothing but temporary effects of supply shocks, temporary fiscal transfers, exchange rates changes; and the "supply" shocks are permanent effects caused by such factors such as oil prices, tax rates, public spending and factor prices. Despite this criticism the approach of Bayoumi and Eichengreen can be implemented to identify the symmetry of shocks between countries.

**The Unit root**

There are several problems that can arise by applying VAR. Using VAR demands that the analyzed data are stationary. The process followed by data should not contain a unit root. The VAR stability condition can be checked. For example, EViews reports the inverse roots of the characteristic AR polynomial. The estimated VAR is stable if all roots have modulus less than one and lie inside the unit circle. Otherwise not all results are valid, for instance, the impulse response standard errors (EViews 6 User's Guide 2007).

The second problem is the identification of right amount of lags since the true process is unknown. Choosing too many lags it will reduce the forecast precision of the corresponding VAR model. In turn the estimation precision of the impulse responses depends on the precision with which the VAR parameters were estimated. That is why it is important to choose the number of lags correctly. The sequential modified likelihood ratio (LR) with Sims' small sample modification is used to identify the length of lag (Lütkepohl 2005).

# Data and results

Quarterly seasonally unadjusted data on real and nominal GDP over a period from 2000 to 2010 were collected from the UNECE Statistical Database for seven CIS countries: Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia and Ukraine; for Georgia that is ex-member of CIS, France, Italy and Germany. Data for Moldova were obtained by separate request to Statistical Division of UN Economic Commission for Europe. The original data from the site contained the noticeable mistakes that could lead to wrong results (according to original data the deflation in Moldova was 89% in the first quarter 2010).

Russia, Germany, Italy and France are chosen as the anchor countries because they are the biggest economies in the Continental Europe. Russia was chosen also due to the particular role that it has in the Commonwealth of Independent States. The quarterly data for the rest of CIS members[1] are not available. For several countries, data are not available for 2000 and the second half of 2010. Data were seasonally adjusted using the moving average method. Growth and inflation were calculated as the first difference of logarithm of real GDP and the implicit GDP deflator. The choice in favor of using the first difference is due to the problem of stationarity. The results of the test proved that this approach helped to solve the problem of stationarity. Checking VAR stability condition gives positive results, with no roots of characteristic polynomial lying outside the unit circle. VAR for each country satisfies the stability condition. For estimation of VAR the lag length equal 4 was chosen based on the Sims' criteria.

As stated in introduction, the purpose of this paper is to identify whether the considered countries are exposed to asymmetric or symmetric demand and supply shocks. Before investigating the properties of shocks it is useful to have a look at data in unprocessed

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[1] These countries are: Armenia, Tajikistan, Turkmenistan and Uzbekistan

form. Table 1 provides the standard deviation and the mean of inflation. On average Germany, France, Italy and Georgia have the lowest inflation in considered period. France, Italy and Germany are characterized as countries with strict anti-inflation policy and stable economies. Meanwhile the highest inflation is in Kazakhstan, Russia, Ukraine and Belarus. The inflation in Russia is high, but the standard deviation is low. It can be the result of the Central Bank's policy. From 2000 the Russian Central Bank concentrated on the exchange rate targeting which helped to protect domestic producers from import competition, as a result inflation remained high, but stable (Granville, Mallick, 2010).

**Table 1**
**GDP deflator: means, medians, maximums, minimums, and standard deviations**

|            | Mean  | Median | Maximum | Minimum | Std. Dev. |
|------------|-------|--------|---------|---------|-----------|
| Azerbaijan | 0.024 | 0.014  | 0.293   | -0.192  | 0.089     |
| Belarus    | 0.063 | 0.053  | 0.259   | -0.026  | 0.062     |
| France     | 0.004 | 0.005  | 0.012   | -0.007  | 0.004     |
| Georgia    | 0.016 | 0.018  | 0.072   | -0.043  | 0.025     |
| Germany    | 0.002 | 0.002  | 0.013   | -0.004  | 0.003     |
| Italy      | 0.006 | 0.005  | 0.020   | -0.005  | 0.006     |
| Kazakhstan | 0.032 | 0.009  | 0.188   | -0.096  | 0.075     |
| Kyrgyzstan | 0.020 | 0.021  | 0.121   | -0.083  | 0.045     |
| Moldova    | 0.026 | 0.014  | 0.150   | -0.039  | 0.046     |
| Russia     | 0.034 | 0.037  | 0.085   | -0.030  | 0.024     |
| Ukraine    | 0.038 | 0.037  | 0.126   | -0.046  | 0.034     |

Note: Variables measured in first log differences, and the data are seasonally unadjusted
The red shaded cells are the maximums; the yellow shaded cells are the minimums

Table 2 shows the standard deviation and mean of real output growth. The lowest growth is in Italy, Germany, France and Kyrgyzstan. The highest is in Moldova, Belarus, Kazakhstan and Azerbaijan. Belarus has been developing its own industrial production during the last decade; Kazakhstan and Azerbaijan have had the impulse to grow due to developing the oil industry (Economic trends and prospects in developing Asia). The lowest standard deviation of growth is in France, Italy, Germany and Belarus. First three are stable developed economies. The last one had been demonstrating stable slow growth, developing under the strong control from the government, at least till the recent past.

**Table 2**
**Real output growth: means, medians, maximums, minimums, and standard deviations**

|            | Mean  | Median | Maximum | Minimum | Std. Dev. |
|------------|-------|--------|---------|---------|-----------|
| Azerbaijan | 0.033 | 0.026  | 0.172   | -0.179  | 0.056     |
| Belarus    | 0.017 | 0.019  | 0.050   | -0.025  | 0.016     |
| France     | 0.003 | 0.003  | 0.013   | -0.019  | 0.007     |
| Georgia    | 0.014 | 0.016  | 0.096   | -0.087  | 0.038     |
| Germany    | 0.002 | 0.004  | 0.019   | -0.030  | 0.010     |
| Italy      | 0.001 | 0.002  | 0.017   | -0.029  | 0.010     |
| Kazakhstan | 0.019 | 0.018  | 0.109   | -0.094  | 0.036     |
| Kyrgyzstan | 0.008 | 0.012  | 0.103   | -0.133  | 0.053     |
| Moldova    | 0.014 | 0.014  | 0.104   | -0.135  | 0.052     |
| Russia     | 0.011 | 0.014  | 0.040   | -0.073  | 0.021     |
| Ukraine    | 0.009 | 0.014  | 0.078   | -0.089  | 0.038     |

Note: Variables measured in first log differences, and the data are seasonally unadjusted
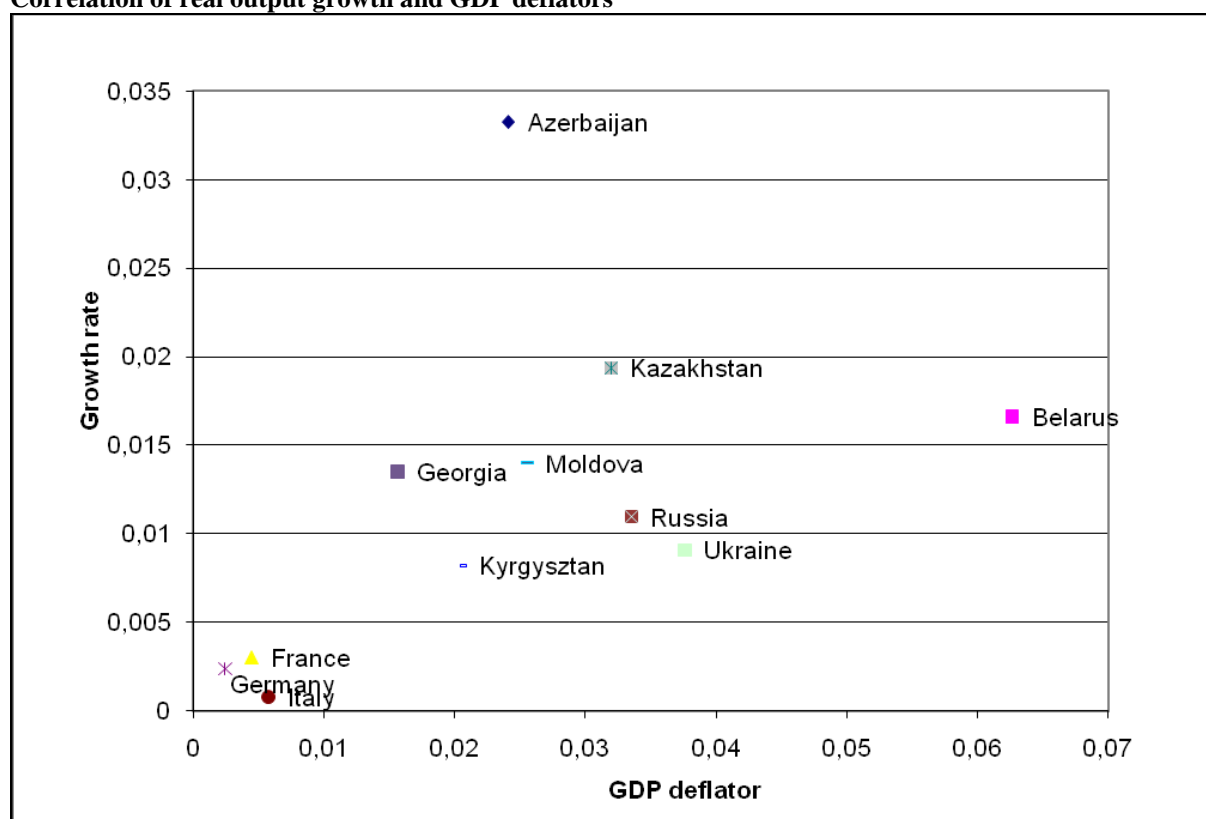The red shaded cells are the maximums; the yellow shaded cells are the minimums

**Figure 1**
**Correlation of real output growth and GDP deflators**

Figure 1 illustrates the correspondence of growth and inflation. Most of countries are allocated in the centre of the graph, with high rate of growth and inflation. Three European countries are different from others having the low rate of growth and inflation. Belarus and Azerbaijan are located in different sectors. Azerbaijan is characterized by relatively higher growth and Belarus is by higher inflation. The main source of growth in Azerbaijan is the rapid expansion of oil production. The stable exchange rate (against the U.S. dollar), moderate expansion in credit helped to decrease inflation (Asian Development Bank 2010, p. 97).

The main factors of Belarusian growth can be divided into two groups. The first group is the supply factors that include capital stock, labour, capital utilization, and productivity. Belarus managed to sustain the competitiveness in the automobile and tractor industry in the CIS market and chemical and oil industries in the European markets. The labour force is well-educated, and the labour outflow was less intensive than in other CIS countries. Both capital and labour were utilized at high rate. Based on previous factors the productivity was increasing.

The second group is the demand factors. Both the domestic and foreign demands were increasing, especially the increase in export to Russian market. The energy subsidies from Russia, substantial investment under government programs, subsidized lending by government helped to increase investments and demand (IMF 2010).

The energy subsidies of Russia are not only source of growth in other countries. The remittance from Russia was one of the factors that were boosting growth for Armenia, Georgia, the Kyrgyz Republic, and Tajikistan for years before the global recession started (Asian Development Outlook 2010 Update). Figure 2 illustrates the remittance reliance in Georgia and Tajikistan.

**Figure 2**
**Remittance reliance**
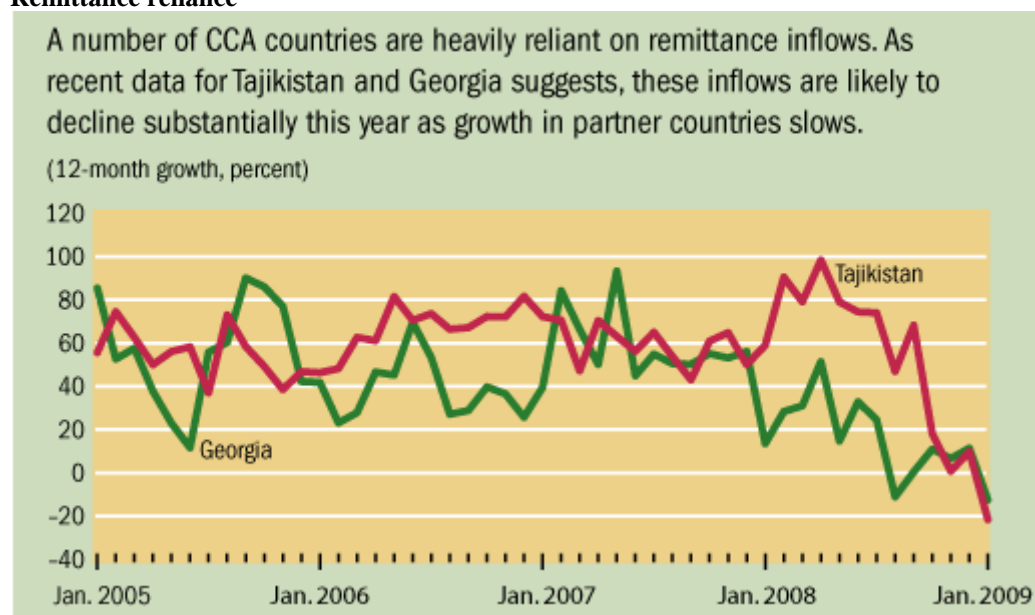


Source: Jardaneh (2009)

In the next part I follow the steps described in the methodology section and calculate the demand shocks correlations between the countries. Table 3 illustrates the correlation of demand shocks among countries. From this table it is possible to see that the correlations of demand shocks are relatively low. The highest absolute value of the coefficient is about 60 per cent, and only few coefficients are significant.

In the OCA literature the supply shocks are considered to be more informative for evaluating the symmetry of shocks (Zhang, Sato, McAleer 2003). Table 4 provides the correlation coefficients of supply shocks. There are more significant coefficients. The highest correlations are between Germany, France and Italy, which confirms our expectation as these countries are already members of the monetary union. These results correspond to ones that were obtained in previous research. The table 5 provides the results of works by Bayoumi and Eichengreen (1992), Funke (1997), Dibooglu and Horvath (1997). The correlation coefficients between CIS countries are significantly weaker, but still positive in the number of cases

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**Table 3**
**Correlation of Demand Shocks of the CIS Countries and Large Western Economies**

|  | Azerbaijan | Belarus | France | Georgia | Germany | Italy | Kazakhstan | Kyrgyzstan | Moldova | Russia | Ukraine |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Azerbaijan | 1 | | | | | | | | | | |
| Belarus | 0.245405 | 1 | | | | | | | | | |
| France | -0.03696 | -0.25314 | 1 | | | | | | | | |
| Georgia | 0.07784 | 0.226137 | -0.06639 | 1 | | | | | | | |
| Germany | -0.04857 | -0.02306 | 0.019264 | -0.04098 | 1 | | | | | | |
| Italy | 0.03613 | -0.29977 | 0.201641 | -0.13529 | 0.233362 | 1 | | | | | |
| Kazakhstan | 0.13638 | 0.298027 | -0.20354 | 0.286729 | -0.26069 | -0.21311 | 1 | | | | |
| Kyrgyzstan | 0.594474 | 0.152902 | -0.04628 | 0.13412 | -0.12181 | -0.19105 | 0.363265 | 1 | | | |
| Moldova | 0.499369 | 0.153543 | -0.00643 | -0.01484 | 0.079651 | -0.16782 | 0.134289 | 0.605394 | 1 | | |
| Russia | 0.356417 | 0.162392 | -0.54374 | 0.045216 | -0.16903 | 0.027443 | 0.19638 | 0.095437 | 0.064279 | 1 | |
| Ukraine | -0.25116 | 0.066489 | 0.021918 | 0.00084 | 0.474936 | 0.239868 | -0.09309 | -0.3252 | -0.35118 | 0.033068 | 1 |

Note: The shaded values denote significant at 5% level

**Table 4**
**Correlation of the Supply shocks among the CIS Countries and Large Western Economies**

| | Azerbaijan | Belarus | France | Georgia | Germany | Italy | Kazakhstan | Kyrgyzstan | Moldova | Russia | Ukraine |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Azerbaijan | 1 | | | | | | | | | | |
| Belarus | -0.01237 | 1 | | | | | | | | | |
| France | 0.196762 | 0.231676 | 1 | | | | | | | | |
| Georgia | 0.36875 | 0.045388 | 0.301047 | 1 | | | | | | | |
| Germany | 0.034817 | 0.398803 | 0.70663 | 0.191744 | 1 | | | | | | |
| Italy | 0.145881 | 0.449429 | 0.640638 | 0.045885 | 0.651192 | 1 | | | | | |
| Kazakhstan | 0.36038 | 0.165526 | 0.210737 | 0.364006 | 0.273901 | 0.022166 | 1 | | | | |
| Kyrgyzstan | -0.0348 | -0.16846 | 0.173455 | 0.204528 | 0.008306 | 0.11769 | 0.2463 | 1 | | | |
| Moldova | 0.094605 | 0.101213 | -0.1394 | -0.06687 | -0.10176 | 0.123495 | 0.158483 | 0.153383 | 1 | | |
| Russia | 0.186203 | 0.420625 | 0.404934 | 0.245336 | 0.460236 | 0.322463 | 0.390784 | -0.15284 | 0.175065 | 1 | |
| Ukraine | 0.191157 | 0.36682 | 0.010729 | -0.15691 | 0.146861 | -0.02565 | 0.159236 | -0.26892 | -0.01916 | 0.270491 | 1 |

Note: The shaded values denote significant at 5% level

**Table 5**
**Correlation of exogenous shocks between Germany and selected western European countries**

| | Supply Shocks | | | Demand Shocks | | | Fiscal Shocks |
|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | C |
| France | 0.54 | 0.26 | 0.37 | 0.35 | 0.14 | 0.07 | 0.37 |
| United Kingdom | 0.11 | 0.45 | 0.36 | 0.16 | 0.31 | 0.00 | 0.11 |
| Italy | 0.23 | -0.05 | 0.35 | 0.17 | -0.28 | 0.09 | 0.38 |
| Netherlands | 0.59 | 0.51 | 0.45 | 0.17 | 0.47 | 0.32 | 0.05 |
| Belgium | 0.61 | 0.40 | 0.21 | 0.33 | 0.18 | 0.04 | 0.20 |
| Denmark | 0.59 | 0.31 | 0.42 | 0.39 | 0.24 | -0.04 | -0.13 |
| Ireland | -0.06 | -0.04 | 0.07 | -0.08 | 0.16 | -0.09 | 0.12 |
| Spain | 0.31 | -0.25 | -0.02 | -0.07 | 0.10 | -0.12 | -0.01 |
| Portugal | 0.21 | 0.14 | 0.01 | 0.21 | 0.22 | -0.02 | -0.07 |
| Greece | 0.14 | 0.21 | 0.13 | 0.19 | 0.22 | 0.15 | 0.08 |
| Austria | 0.62 | -0.26 | 0.34 | 0.17 | 0.12 | | |
| Finland | 0.22 | 0.12 | -0.01 | 0.11 | 0.00 | | |
| Norway | -0.06 | -0.25 | 0.12 | 0.22 | 0.16 | | |
| Sweden | 0.35 | 0.20 | -0.09 | 0.26 | -0.01 | | |

Note:
Results of structural vector autoregressive estimations
A. Bayoumi and Eichengreen (1992) based on yearly data for the period 1960-1988.
B. Funke (1997) based on yearly data for the period 1964-1992.
C. Dibooglu and Horvath (1997) based on yearly data for the period 1950-1994.
Source: Horvath (2003)

The lower correlation of supply shocks can be a result of the decrease in inter-regional trade. The decrease in interregional trade can be explained by an increase in energy delivery of Russia to non-CIS countries. The preferences in import also changed; the demand on equipment produced outside the CIS is increasing. Meanwhile the share of European Union and China in trade turnover is increasing significantly. The same is typical for foreign investments from CIS countries. Only Belarus has an increase in foreign investments mainly because of Gazprom's payments for shares of Beltransgaz and investments in authorized capital stock of Belorussian banks (Likhachev 2010, p. 11).

The data about foreign investments might be misleading. For instance, the importance of portfolio investment from Russia to other countries in the region is not clear. There is suspicion that most of the portfolio investments from international finance centers actually

come from Russia. For example the data suggest that Kazakhstan receive 50 times more funds from Guernsey than from Russia (IMF 2008).

**Figure 3**
**Capital flows**
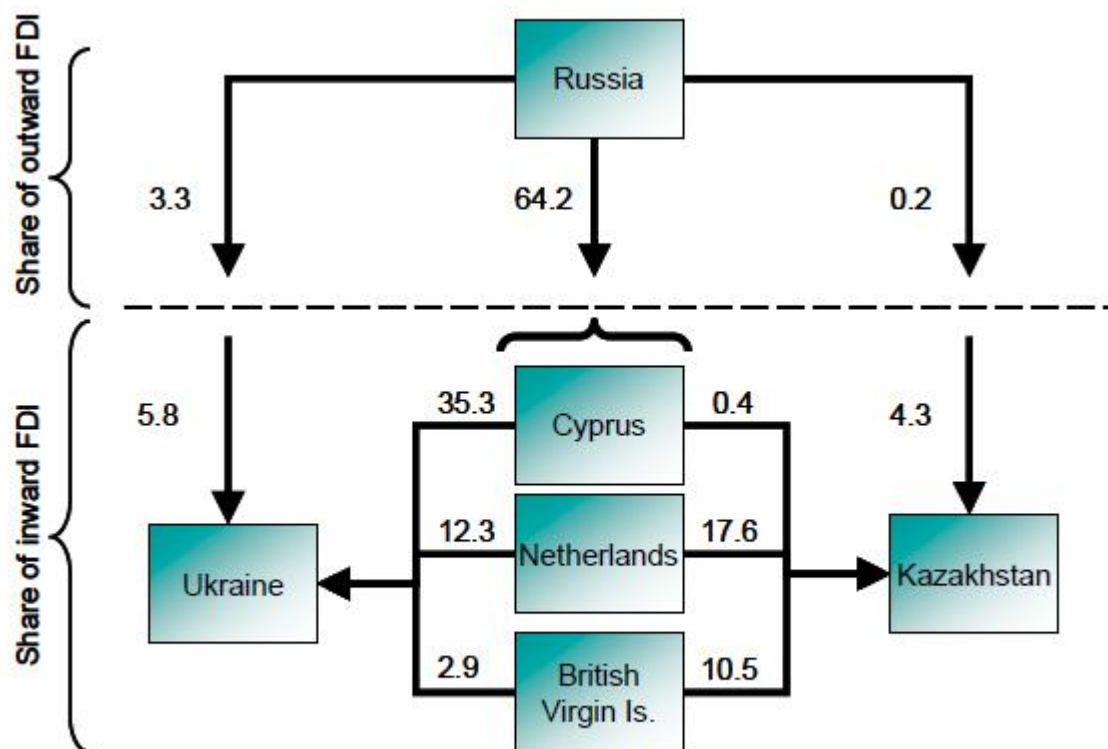


Source: IMF (2008)

Russian supply shocks are positive and significantly correlated with three countries of the European Union and with two CIS countries: Belarus and Kazakhstan. The last two and Russia formed the Customs Union in September 2005. Leaders of Russia, Belarus and Kazakhstan took the decision to move in the direction of forming common markets of goods, services, capital and labour. They also underlined the future possibility to form the currency union. (Likhachev, 2010, p. 9).

Such correlation coefficients correspond to the results of the Canadian economist Vlad Ivanenko (2007). In his research using the conception of the trade gravitation he showed that Russia has two main groups of trade partners: post-soviet countries and members of European

Union. In the first group the most gravitated countries are Ukraine, Belarus, Kazakhstan and Moldova (the shortest "distance" in CIS is between Russia and Belarus). In the second group it is Finland, Germany, Netherlands and Italy (Kosikova 2008, p.33).

The supply shocks in Kazakhstan and Belarus are positively and significantly correlated with the supply shocks in Russia, but they are not correlated between themselves. At the same time the share of trade turnover between Kazakhstan and Belarus in total trade turnover of Customs Union is very small, no more than 1%, the rest 99% is the trade between Russia and Belarus, Russia and Kazakhstan (Likhachev, 2010 p. 12).

Overall the results indicate that the CIS countries co-move to some degree. The strongest relations are between Belarus, Kazakhstan and Russia. These countries have taken some steps toward closer integration. By this time only these three countries can be considered as potential members of the currency union. For other countries, the results do not support the idea of forming an optimum currency area.

# Conclusion

In my thesis I used structural vector autoregressive model to identify the supply and demand shocks among the CIS countries, and among CIS and large European economies. The results showed that the CIS countries are usually not exposed to symmetric demand shocks, but the supply shocks are more symmetrical. The supply shocks in anchor countries are correlated. Despite the pair correlations of shocks in some countries, the only candidates for forming an optimal currency area are according to my findings are the members of the Customs Union, Russia, Kazakhstan and Belarus. These three countries correspond to the criterion of symmetry of shocks. Moreover they meet other criteria suggested by the optimum currency area theory. They have relatively high degree of trade integration. These countries took some steps toward the fiscal coordination (export tax). The role of Russian ruble is increasing in the region. Russia has several agreements with its trade partners about international settlements that stipulate the use of national currencies along with other convertible currencies. In 2009 48% of payments in the Eurasian Economic Community were made in rubles (Potemkin, 2010).

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